

# Claims

- [c1] 1. A digital-to-analog converter comprising:
- a band gap voltage regulator;
  - a voltage divider comprising a plurality of tunneling n-type field effect transistors (NFETs) connected to said band gap voltage regulator;
  - a multiplexer connected to said voltage divider;
  - a digital decoder connected to said multiplexer;
  - an operational amplifier connected to said multiplexer; and
  - an input binary word component connected to said digital decoder;
- wherein outputs of said digital decoder are input into said operational amplifier and converted as analog output.
- [c2] 2. The digital-to-analog converter of claim 1, wherein said multiplexer comprises any of a NFET, a p-type field effect transistor (PFET), and a combination thereof.
- [c3] 3. The digital-to-analog converter of claim 1, further comprising a capacitor connected to said operational amplifier.

- [c4] 4. The digital-to-analog converter of claim 3, wherein said multiplexer and said capacitor comprise an oxide of at least 5 nm in thickness.
- [c5] 5. The digital-to-analog converter of claim 1, further comprising a binary-weighted tunneling current device connected to said digital decoder.
- [c6] 6. The digital-to-analog converter of claim 5, wherein said tunneling current device outputs tunneling current, wherein said tunneling current is adjusted in proportion to a binary weight of said input binary word component.
- [c7] 7. The digital-to-analog converter of claim 5, further comprising:  
a node coupled to said digital decoder;  
at least one current supply field effect transistor (FET) coupled to said node; and  
an output FET operable for supplying a current proportional to a current of said current supply FET;  
wherein said current supply FET is operable for maintaining voltage on said node constant.
- [c8] 8. The digital-to-analog converter of claim 1, wherein said voltage divider comprises a NFET in parallel with each said tunneling NFET.
- [c9] 9. A digital-to-analog converter comprising:

a voltage source supply;  
a voltage division stack connected to said voltage source supply;  
a multiplexer connected to said voltage division stack;  
a digital circuit connected to said multiplexer;  
an analog circuit connected to said multiplexer; and  
an input binary word source connected to said digital circuit;  
wherein outputs of said digital circuit are input into said analog circuit and converted as analog output.

- [c10] 10. The digital-to-analog converter of claim 9, wherein said multiplexer comprises any of a n-type field effect transistor (NFET), a p-type field effect transistor (PFET), and a combination thereof.
- [c11] 11. The digital-to-analog converter of claim 9, further comprising a capacitor connected to said analog circuit.
- [c12] 12. The digital-to-analog converter of claim 11, wherein said multiplexer and said capacitor comprise an oxide of at least 5 nm in thickness.
- [c13] 13. The digital-to-analog converter of claim 9, further comprising a binary-weighted tunneling current device connected to said digital circuit.

- [c14] 14. The digital-to-analog converter of claim 13, further comprising:
- a node coupled to said digital circuit;
  - at least one current supply field effect transistor (FET) coupled to said node; and
  - an output FET operable for supplying a current proportional to a current of said current supply FET;
- wherein said current supply FET is operable for maintaining voltage on said node constant.
- [c15] 15. The digital-to-analog converter of claim 13, wherein said tunneling current device outputs tunneling current, wherein said tunneling current is adjusted in proportion to a binary weight of said input binary word source.
- [c16] 16. The digital-to-analog converter of claim 9, wherein said voltage division stack comprises an NFET transistor in parallel with a tunneling NFET.
- [c17] 17. The digital-to-analog converter of claim 9, wherein said digital circuit comprises a NAND device.
- [c18] 18. The digital-to-analog converter of claim 9, wherein said analog circuit comprises an operational amplifier.
- [c19] 19. A method of converting a digital signal into an analog signal, said method comprising:

arranging a plurality of n-type field effect transistors (NFETs) into a voltage division stack;  
applying a regulated output of voltage to said voltage division stack;  
applying a binary-weighted input word to a digital circuit;  
applying a voltage output of said voltage division stack to each of a multiplexer and said digital circuit;  
generating a digital output from said multiplexer and said digital circuit;  
inputting said digital output into an analog circuit;  
and  
converting said digital output into an analog output.

- [c20] 20. The method of claim 19, further comprising connecting a binary-weighted tunneling current device to said digital circuit, wherein said tunneling current device outputs tunneling current, wherein said tunneling current is adjusted in proportion to a binary weight of said input binary word source.